METHOD OF AND APPARATUS FOR WEAVING LENO FABRIC

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Inventor
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Fig. 9

P.d.

Fig. 5

20

22

17

18

R'

A

K'

Figs. 5

23

22

31

47

L

Fig. 9

22
METHOD OF AND APPARATUS FOR
WEAVING LENO FABRIC

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Application September 5, 1947, Serial No. 772,434

15 Claims. (Cl. 159—51)

For figure weaving it is customary to provide a bank of standard harnesses and to draw in the standard threads in accordance with some predetermined pattern, and provision is made for automatically suspending the douping action and imparting a full shedding action to some or all of the standard harnesses while the douping thread remains idle.

While certain features of my invention are of utility in leno looms having a single harness of standard healds, added advantages result from incorporation of the invention in leno looms having a plurality of such harnesses. Thus such plurality of harnesses are needed to accommodate the necessary number of healds for fine weaving, and more especially, as above suggested, to give selective control of groups of these healds in weaving a pattern during suspension of leno weaving. Therefore, the invention will be explained as incorporated in a leno loom having a plurality of rows of harnesses of standard healds, some, at least, of which cooperate with the douping needles in leno weaving but which act alone to weave plain fabric during suspension of leno weaving.

Especially in leno looms of this type difficulties have long been encountered due to the different effects which are produced in douping to the two different sides of the standard thread, and, although efforts have been made to minimize such differences, the difficulty has remained and constitutes a source of great inconvenience.

In customary leno lores, when a douping thread is passed to one side of its corresponding standard thread (in the present disclosure the right side), a so-called “slack shed” is formed, and when the douping thread is passed to the opposite side (here the left side) of its standard thread, a so-called tight shed is formed. Obviously it would be desirable if the douping threads could be tensioned to the same degree whenever the leno shed is open, whether the douping thread has been raised at the right or left of its associated standard thread, thus avoiding the alternate tight and slack sheds.

Customarily the cooperating douping and standard threads of a pair are disposed in side-by-side relation (in parallel vertical planes) at the location of the heald eye through which the standard thread passes. Assuming that in the closed shed the douping thread is at the right (as the weaver faces the loom) of the associated standard thread, then in douping to the right the douping thread merely rises in its own vertical plane. However, in douping to the left, the douping thread in which each warp is always disposed in the same vertical plane, and weaving according to any pattern, during suspension of leno weaving, is herein referred to, for convenience, as “plain” weaving.

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douping to the right is looser (slack shed) than when douping to the left (tight shed).

At each opening of the shed, in leno weaving, a crossed standard and doup thread of a pair diverge rearwardly from the fell of the cloth, and, as viewed from the side of the loom (although they may not actually touch each other), appear, when so viewed against a vertical plane, to make an acute angle with one another. At the rear of the open leno shed, the standard and doup threads diverge rearwardly, and when similarly viewed (although they may not actually touch) appear to make an acute angle with each other in the vertical plane. Hereinafter, for convenience in description, these apparent angles, as seen against a vertical plane, will be referred to as the front and rear "shed-angles," respectively. The present invention is particularly concerned with preventing the apex of the rear shed-angle from approaching too closely to the heddle through whose eye passes the standard thread of a given pair, especially those heddles nearest to the doup needles.

In customary leno looms the paths of a cooperating pair of doup and standard threads are such that the apex of the rear shed-angle, induced by the doup and standard threads may occur to the rear of the heddle of the corresponding standard thread when forming the slack shed, but in forming the tight shed the apex of the rear shed-angle can no longer occur at such location but only forwardly of the heddle eye which carries the corresponding standard thread, the threads mutually restraining each other in vertical planes, in front of the heddle. The doup thread thus urges the standard thread to a less open shed position, and the standard thread tends to pull the doup thread down so that the run of doup thread, extending to the doup needle eye, makes a less acute angle with the run of standard thread which extends forwardly to the fell of the cloth than during the formation of the slack shed.

The mutual deflection of one thread by the other in forming the tight shed involves a bending of each thread around the other and consequent increased tension and friction in forming the tight shed. This effect is increased by the fact that the threads attain a mutually deflecting relation before the shed is fully opened and thereafter saw past one another as the shed continues to open.

Modern standard heddles used in leno weaving consist essentially of vertical, generally flat metal strips which lie in planes generally parallel to the direction of the warp. When the doup thread is crossed, in usual prior fashion, with the standard thread in the formation of the tight shed, the doup thread can readily jam in between the flat surface of the heddle and the portion of standard thread which has just emerged from the heddle eye, the restraint exerted by the standard thread upon the doup thread tending to hold the doup thread in this jammed condition. Objectionable chafing of the thread thus occurs at the standard heddles, this chafing constituting a source of trouble in the woven fabric. As indicated above, each pick of filling thread binds into the fabric a crossing of the doup and standard threads. When successive crossings are tight and loose, then each newly beaten-in tight crossing tends to transfer its tension to the next loose crossing, and this tension tends to cause each tight pick, that is each pick woven through a tight shed, to back off away from the preceding pick, causing the filling threads in the woven fabric to appear in pairs rather than equally spaced.

Moreover, the tensions can not be fully equalized merely by allowing the tight shed to be smaller than the slack shed because in forming the tight shed the doup threads, as they chafe by the standard threads and standard heddles and the standard threads and so reduce the size of the shed, this type of reduction in the size of the shed not being accompanied by reduction in the doup thread tension but, on the contrary, tending to increase the tensions of both the doup and ground threads.

In ordinary plain or one-and-one weaving, alternate threads of the warp shed first form the upper and then the lower wall of the open shed. In contrast with this, in plain leno weaving, alternate warp threads (for example the doup threads) always form the same shed wall (usually the top wall), while the intervening warp threads (standard warps) always form the other wall of the shed (usually the bottom wall). Furthermore, in plain leno weaving, it is customary to place both doup and standard threads in the closed-shed position at the instant of doubling in order to facilitate the crossing of the doup threads beneath the standard threads and at the same time to avoid excessive lift of the doup threads. To insure a sufficiently open shed, the standard threads are moved downwardly from the closed-shed or mid-position as the shed is opened, the standard thread harness being given a half-shedding motion by the dobby mechanism.

Since the standard threads thus move away from the mid-position as the shed opens it is necessary to locate the dead rod (around which all of the doup threads pass) so that it will not interfere with the motion of the standard threads.

In a loom designed to weave plain leno only it is sometimes possible to locate the dead rod immediately to the rear of the standard heddles (and not far below the mid-plane of the warp sheet), and thus the run of doup thread, extending forwardly from the dead rod to the doup needle eye, inclines upwardly and forwardly with a relatively slight slope and consequently makes an obtuse angle with the front shed shed. In this case the thread extending from the doup needle eye. However, when the loom is designed for weaving figured fabrics (including plain weaving as well as leno weaving) which necessitates the provision of a substantial number of standard harnesses with provision for moving these harnesses both up and down (and usually to a greater extent than is
necessary in leno weaving), the location of the dead rod, so that it will not interfere with the standard harnesses, is important where it will insure an acceptable upward slope of the run of doup thread leading toward the doup needle eye in the open shed, becomes a matter of substantial difficulty. For this class of weaving a bank of twelve or more harnesses is not uncommon. Such a bank of harnesses occupies a very substantial space (from front to rear) in the loom so that in a loom using the usual standard thread heddles, it is no longer possible to locate the dead rod at the most desirable position. This situation is necessary to give full play to the doup threads and to help to maintain the tension on the doup threads in the closed shed position.

In the embodiment of the invention herein chosen for illustration, the doup needles are attached to their actuating rods below the shedding point, just as in the standard looms. However, it is to be understood that the invention is equally applicable to apparatus of the kind in which the doup needles are attached to their actuating rods above the shed line and known as top doup. Thus, although for convenience in description use is herein made of such expressions as "up" and "down" in describing the motion of certain parts, it is to be understood that these expressions as so used, apply specifically to the embodiment actually shown, and are not to be regarded as limiting the application of the invention.

As indicated above, the present invention aims to avoid the various disadvantages described above. More particularly, the invention aims to reduce and equalize thread tensions and to enable the two open leno sheds to be of substantially the same size and shape and to be formed with equal facility in a leno loom designed for figure weaving, and to enable the loom to be set up for operation with the minimum of effort.

Other and further objects and advantages of the invention will be pointed out in the annexed specification and by reference to the accompanying drawings wherein:

Fig. 1 is a more or less diagrammatic elevation of a leno loom embodying the present invention, designed for figure weaving and, viewed from the right-hand side of the loom, indicating the positions of the lay, the dou pneedle harness, a plurality of standard harnesses and the dead rod, with the parts positioned as they appear after the shed has been opened in doup to the left;

Fig. 2 is a view generally similar to Fig. 1 but omitting some of the parts and showing the loom when the leno shed is closed;

Fig. 3 is a diagram, omitting many of the parts shown in Fig. 1, to illustrate the general shape and location of the shed formed in doup to the right in leno weaving, in accordance with the present invention;

Fig. 4 is a diagram generally similar to Fig. 3 but illustrating the shape and location of the shed formed in doup to the left in leno weaving, in accordance with the present invention;

Fig. 5 is a view illustrating a common shape of shed formed in doup to the left in a leno loom of the customary prior construction;

Fig. 6 is a similar view showing a common shape of shed formed in doup to the right in the ordinary leno loom;

Fig. 7 is a side elevation of a doup needle of a standard type such as may be used in the practice of the present invention;

Fig. 8 is a view generally similar to Fig. 1 but showing the parts arranged for plain weaving.

with the doup needles in the closed-shed position, and with the standard heddles arranged in open-shed position; and

Fig. 9 is a fragmentary section through a piece of leno fabric, illustrating the way in which the weft picks interlock with the standard and doup warps.

Although various forms of mechanism may be used to pass the doup threads on alternating sides of the ground threads and to carry the doup threads to open-shed position, the invention is, as indicated above, illustrated as employing doup heddle mechanism having the general construction of those of United States Patents Nos. 1,097,150; 1,097,151; and 2,049,911. The illustration of this mechanism will not be described in detail because it is well known in the art, and the aforesaid patents may be referred to as showing details of construction.

As shown in Figs. 1 and 7 of the drawings, the doup heddle, indicated generally by the reference character 16, includes a doup needle 11 of generally inverted U-shape, having a rounded upper end 12 at which is located an eye 13 for the doup thread. Each of the depending legs L of doup needle 11 is preferably provided, as is well known, with a slot 14 for the reception of a harness rod 14 (Fig. 8) so actuated as yieldingly to urge the doup needle downwardly.

The illustrated doup heddle 16 further includes two lifting heddles 17 and 18. Lifting heddle 17 is provided at its top and beam with slots for the reception of the horizontal rods of one harness 22, and lifting heddle 18 is provided at its top and beam with slots for the reception of the horizontal rod of another harness 20, the two harnesses and their lifting heddles 17 and 18 being moved up and down by a dobby motion (not shown) as customary in leno weaving.

Each lifting heddle 17 and 18 comprises a twoply portion, between the two plies of which one of the respective legs L of the doup needle 11 extends, so that the doup needle is lifted by whichever lifting heddle 17 or 18 is raised by its harness at the moment.

Each doup thread d extends through the eye 12 of one of the doup needles, as indicated above, and also between the two lifting heddles 17 and 18. The standard thread s is threaded between the two lifting heddles 17 and 18 in the same direction as the doup thread but does not pass through the eye of the doup needle. Fig. 8 shows the parts in the positions which they occupy when the shed is closed for leno weaving. As illustrated, the standard thread s and the doup thread d do not cross when the shed is closed. The construction of the doup heddle 16 is such that when the threads are passed through it, as shown in the drawings, the raising of the lifting heddles 17 carries the doup thread d above the standard thread s on the far side of the latter, as viewed in Figs. 1 and 4, thus doup to the left. Similarly raising the lifting heddle 18 carries the doup thread d above the standard thread s on the near side of the latter, as shown in Fig. 3, thus doup to the right. After the formation of each successive open shed in leno weaving, whether doup to the right or left, the shuttle Z passes through the shed, laying a pick P (Fig. 8) of filling between the doup thread d forming the top wall of the shed, and the depressed standard threads s forming the bottom wall of the shed.

The standard harnesses H are shown as eight in number (Fig. 1), although a greater or lesser
number may be used. Each standard heddle 23 is provided at its top and bottom with a slot for the reception of the corresponding standard harness. Somewhat above the mid-point of each standard heddle 23 an eye 35 is provided for the passage of one of the standard threads s. The standard harnesses are actuated by any suitable mechanism, for instance the well-known punch-rod and quadrant, so as to move the harnesses between the positions shown in Fig. 2 and Fig. 3 during levo weaving, that is to say, to impart to the standard harnesses a half-shedding motion so as to carry the standard threads s from the closed-shed position to the depressed, open-shed position and vice versa. Thus in levo weaving the closing of the shed and the opening of the shed are brought about by cooperative actuation of the doup needles and such of the standard harnesses as take part in the levo weaving, each of these elements moving from the closed-shed position, such as shown in Fig. 2, alternately to the open-shed positions of Figs. 1 or 3.

The doup threads d, which have been separated from the standard threads of the warp by any suitable guides, pass forwardly toward the doup needle eye on the near side of the standard heddles 23 (douping to the right with slack shed formation), the apex of the rear shed angle A would be located to the rear of the standard heddle 23 carrying the corresponding standard thread s (at least as respects the forwardly located harness). The angle G between the runs R1 and R2 of doup thread at the front and rear of the doup needle is thus very obtuse. On the other hand, the apex of the rear shed angle A will be disposed forwardly of the standard heddle 23, the corresponding standard thread when the doup thread is crossed to the far side of the standard thread (Fig. 5) in doup to the left, thus making the angle G more acute and producing a tight shed. When the doup thread is thus crossed to the far side of the standard thread (Fig. 5), the apex of the rear shed angle A is necessarily located forwardly of the standard harness heddle 23 and the doup thread is thus held downwardly and displaced from its normal course as shown in Fig. 5 by the tensioned standard thread s while the latter is deflected upwardly (from its normal course between the doup needle and the Fell of the cloth) by the tension of the doup thread, the threads partially wrapping about each other just forwardly of the doup needle. Since the threads are thus partially wrapped before the shed is completely opened, one thread is sawed against the other, causing chafing.

While the variable location of the apex of the rear shed angle A of a single standard thread s of the front standard harness H and its corresponding doup thread d has just been described, certain effects will occur with respect to the vertical and standard thread threads of several of the forwardly located standard harnesses. It may be ascertained (by projecting a straight line from the horizontal rod 31 (Fig. 1) tangent to the doup rod R) that, as illustrated, (at least in the case of the forward harnesses) slack sheds and tight sheds will be formed at alternate douping if the doup threads in customary manner pass the standard heddles while disposed always at the same side of the latter, as illustrated in Figs. 5 and 6.

In accordance with the present invention, the several forward standard harnesses, whose heddles would otherwise form tight and slack sheds, as above described, the closest slots 47 which cooperate with the doup mechanism to insure uniformity of conditions as respects thread-tensioning and shed shape and dimensions when doup to the right and left, respectively. These slots 47 each extend from a point below, and preferably closely adjacent to the eye 35, downwardly substantially to the slot which receives the lower rod 31. The upper end of each slot 47 is separated from the thread eye 35 by a portion of the material of the heddle which thus forms a separator to prevent rubbing contact between the doup and the standard threads when they pass through the heddle. As illustrated in the drawings, each doup thread is threaded through the slot 47 in the same direction that the corresponding standard thread s is threaded through the thread eye 35 of the heddle. The slots 47 are sufficiently long so that when the standard harnesses are used for plain weaving (where levo weaving is suspended and the doup threads are in the depressed idle position), the upward motion of the standard heddles when raised to the extreme upper limit of their shedding motion will not substantially displace the idle runs of doup thread. When the doup thread and corresponding standard thread are thus threaded through the standard heddle, each of these threads extends through the heddle from one side to the other of the latter, and where they thus pass over the heddles they are maintained in substantially the same vertical plane, that is to say, one is substantially directly above the other.

Comparing, for example, the positions of the threads of the visible heddle 23 of the front standard harness H in Figs. 3 and 4, it will be observed that the standard thread s 23 which carries the corresponding standard thread when the doup thread is so arranged that the apex of the rear shed angle A is always located forwardly of the heddle whether doup to the right or left. Moreover, the positioning of the doup thread at the top of its slot 47, which is vertically separated from the standard thread eye 35, insures that the rear shed angle A (whether doup to the right or left) will be prevented from closing rearwardly up upon the heddle 23, and will always occur sufficiently forwardly of the heddle eye to prevent the doup thread from being jammed or chafed between the standard thread and heddle. Neither the doup thread nor standard thread is deflected vertically by the other at any point between the standard harness and doup needle. There is no tendency for the doup thread to lift the standard thread whether doup to the right or to the left, the result is that one thread is sawed against the other, causing chafing.
and tensions of the standard threads are likewise the same when doubling to the right or left. Thus, the creation of uneven tension and alternate tight and slack sheds is substantially avoided.

Thus, a lower general tension can be employed, and warp breakage is reduced by such lower tension and by the avoidance of excessive tensions during doubling. Warp breakage is reduced by the avoidance of the small-sized shed such as previously has occurred on alternate picks. An adequate-sized shed, which does not squeeze the shuttle, is insured in both doubling to the left and doubling to the right, and the power consumption of the loom accordingly reduced. Any slackening or compensating device employed to relieve tension on the douper threads can operate in the same manner and to the same extent during doubling to the right and doubling to the left, and in adjusting the loom the tension on the threads can be initially adjusted at either open shed position of Fig. 1 or of Fig. 3, and will then be the same for the other opposite open shed position.

So-called "tracking" or "pairing" of the picks is avoided by the fact that the same tensions are employed in both open shed positions.

Where the douper and standard threads are threaded through the slot and eye of a heddle as described above, it is more convenient to thread them through the heddle from the same side, as illustrated in the drawings, but this is not essential and the douper and standard threads could be threaded through the standard heddle from opposite sides if desired and otherwise have the same course shown in the drawings.

The loom illustrated in the diagrams is adapted for weaving so-called figured goods by a proper shedding of the standard threads during suspension of leno weaving. In Fig. 8 the douper heddles 18 are shown as lowered so as to depress the douper threads and cause them to lie inactive at the bottom of the doubling shed, the mechanism for lifting the heddles 17 and 18 being temporarily inactive. The standard harnesses, or selected ones of them, are then given a full shedding motion so as to provide for other appropriate mechanism (not shown). Fig. 8 shows by way of example the front harness of the group of harnesses A raised and the next harness to the rear lowered, the slots 41 through which the douper threads pass being so long that the idle douper threads are not depressed by the raising of the harnesses H to the full upward shedding position. It will be understood that after weaving one or more plain picks with the parts disposed as in Fig. 8, the operation of the douper heddles may be resumed so that the loom reverts to the weaving of leno fabric as in Figs. 1, 2 and 3.

I am aware that there has been disclosed in United States Patents Nos. 413,440 and 828,244, primarily for use in weaving tapestry and velvet carpet, a heddle having an eye for one warp yarn and an elongate slot for a stuffer yarn. Such construction of the heddle affords a certain degree of lost motion between the heddle and the stuffer yarn so that the vertical motions of the two yarns can be different.

The present invention, however, for the first time so far as I am aware, employs douper thread slots and douper heddles in leno weaving for cooperative action with doubling mechanism to provide uniformity of conditions in alternately crossing the threads to the right and to the left.

I claim:

1. In combination in a loom of the type which includes means for suspending leno weaving while weaving plain fabric, said loom having douper needles for crossing douper warps with standard warps, and heddles for the standard warps, each standard heddle having an eye for the passage of a standard warp, each standard heddle also having an elongate slot for the passage of the corresponding doubling warp, said slot being long enough to allow full shedding of the standard warp, during plain weaving, without substantial displacement of the douper thread from an inactive position.

2. In combination in a loom comprising doubling mechanism, including douper needles, operative to form sheds of douper and standard threads, the loom including a standard harness of flat metal heddles provided with eyes for the standard threads, each heddle of said harness having, in addition to said eye and separate therefrom, an elongate slot for the reception of the douper thread corresponding to the standard thread which passes through the eye of said heddle and guide means located rearwardly of the standard harness for guiding the doubling threads, the douper heddles, heddle slots and guide means being so located relatively to each other that at each open leno shed the douper thread is positioned by engagement with the end of the slot nearest to said eye.

3. In combination in a loom comprising standard harnesses including flat metal heddles provided with eyes for standard threads, the heddles being operative to move the standard threads between closed shed and open shed positions, a douper harness including douper needles adapted to move douper threads from either side to the opposite side of the corresponding standard threads while in the closed shed position and then to the open shed position, each heddle of at least the forward standard harness having elongate slots for douper threads, separate from the eyes for the standard threads, thereby to prevent vertical deflection of either of corresponding douper and standard threads by the other, in the vicinity of the standard harness, while doubling either to the right or left.

4. In combination in a loom equipped for figure weaving, having appropriate mechanism (not shown) for standard threads for leno weaving, and to form sheds of standard threads during suspenison of leno weaving, the loom including standard harnesses each having heddles provided with eyes for the standard threads, each standard heddle of at least the forward harness having, in addition to said eye and separate therefrom, an elongate slot for the reception of the douper thread corresponding to the standard thread which passes through the eye of said heddle, and a guide rod to the rear of the standard harness for guiding the douper threads on their way to said heddles, a plurality of standard heddles having a half-shedding motion during suspension of leno weaving.

5. In combination in a weaving loom of the kind designed for alternative plain and leno weaving and which comprises douper heddles, a dead rod for guiding douper threads on their way to the douper heddles, a plurality of standard heddles, in leno weaving, which are given a half-shedding motion during leno weaving and a full-shedding motion during plain weaving, and wherein the operation of the douper heddles is suspended during plain weaving, characterized in that each of the heddles of the
foremost, at least, of the standard harnesses has an eye for the standard thread and an elongate slot below the eye for the passage of the corresponding doup thread, the slot being so long that when the standard heddle is moved to form a full shed during plain weaving the course of the idle doup thread is substantially unchanged by movement of the standard heddles.

6. In combination in a weaving loom of the kind designed for alternative plain and leno weaving and which comprises doup needles, a plurality of standard thread harnesses to which a shedding motion is imparted, each heddle of the standard harness being a flat metal strip having an aperture slightly above its mid-point for the passage of a standard thread, characterized in that each standard heddle has an elongate slot below said eye for the passage of the corresponding doup thread, said slot being so long that movement of the heddle to the extreme limits of its shedding motion does not deflect the doup thread.

7. In combination in a weaving loom of the kind designed for alternative plain and leno weaving and which comprises doup needles, a plurality of standard thread harnesses to which a shedding motion is imparted, each heddle of the standard harness being a flat metal strip having an aperture for the passage of a standard thread, characterized in that each standard heddle also has an aperture for the corresponding doup thread of a pair, said latter apertures being so shaped and located that movement of the heddles to the extreme limits of shed formation do not deflect the doup threads from their normal path.

8. In combination in a weaving loom designed to weave leno fabric and which has doup heddles and means for actuating them and standard heddles and means for actuating them, the standard heddles being to the rear of the doup heddles, characterized in that each standard heddle is a flat metal strip having an eye located at a point substantially mid-way its length and a slot extending from a point just below the eye substantially to the lower end of the heddle.

9. In combination in a weaving loom designed to weave leno fabric and which has doup heddles and means for actuating them and standard heddles and means for actuating them, the standard heddles being to the rear of the doup heddles, characterized in that each standard heddle is of metal and has an eye for the passage of the standard thread and an elongate slot for the passage of the corresponding doup thread.

10. In combination in a loom designed to form sheds of doup and standard threads, each shed having a front and a rear angle, the loom including standard harnesses each having heddles provided with eyes for the standard threads, a full shedding motion being imparted to said standard harnesses during plain weaving, characterized in that each heddle, of some at least of said standard harnesses, has an elongate slot for a doup thread, said slot being separate from the eye thereby to insure the location of the rear shed angle at the same point in both right and left doupings positions of the threads.

11. In combination in a weaving loom designed to form sheds of doup and standard threads, each shed having a front and a rear angle, the loom including standard harnesses each having heddles provided with eyes for the standard threads, a full shedding motion being imparted to said standard harnesses during plain weaving, characterized in that each heddle, of some at least of said standard harnesses, has an elongate slot for a doup thread, said slot being separate from the eye thereby to insure the location of the rear shed angle at the same point in both right and left doupings positions of the threads.

12. Method of controlling the warp in a leno loom equipped for figure weaving and having doup needles for crossing doup wars with standard wars and having standard heddles for shedding wars during suspension of leno weaving, characterized in guiding the standard and doup wars of a pair to lie always in the same vertical plane at the location of the standard heddle, suspending the shedding motion of the doup needles during plain weaving, and allowing each standard heddle to move freely relatively to the corresponding doup warp while leaving the latter in a fixed idle position.

13. Method of controlling the warp in a leno loom equipped for figure weaving and having doup heddles for crossing doup wars with standard wars and having standard heddles for shedding wars during suspension of leno weaving, characterized in guiding the standard and doup wars of a pair to lie always in the same vertical plane, at the location of each standard heddle and, during plain weaving, imparting a full shedding motion to each standard warp while maintaining each doup warp in a fixed idle position.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

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<tr>
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FOREIGN PATENTS

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